LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.]*

The Colour of the Scales of Iridescent Insects in Transmitted Light.

CURIOUS as it may seem, the origin of the brilliant metallic and iridescent colours in birds and insects has never been satisfactorily explained, though it is generally supposed among naturalists and others that they are in some way produced by the interference of light at the surfaces of thin plates, as in the soap-bubble.

Nevertheless, various other explanations have been put forward, and Michelson, with the weight of his great authority, decides unequivocally that they are due to selective reflection at the surface of a very opaque film, as in the case of metals or dry films of aniline dyes. For this conclusion he relies upon the "rigorous optical test of the measurement of the phase-difference and amplitude ratios" when polarised light is reflected. This view has, however, by no means gone unchallenged by Lord Rayleigh, Mallock, and others.

Whatever the truth of the matter may finally prove to be, both those who uphold the theory of selective reflection, and those who uphold the theory of interference, emphasise the fact that the light transmitted through the structures must be complementary to the light which is reflected.

Thus Michelson says: "In the cases which could be investigated for this relation (unfortunately rather few) the transmitted light is complementary to that which is reflected"; and Mallock says: "In cases where the structure is transparent it transmits the complementary colour with nearly the same intensity as the colour reflected." Probably the theory of selective reflection would require the transmitted colours to be more vivid than a theory of "thin plates"; and, as Lord Rayleigh has said, the transmitted colour of the surface layer of beetles' wings (or *Emailschicht* of Biedermann, which he obtained by maceration in HNO_3, etc.) "is not nearly so full as it would be if due to anything like an aniline dye."

In spite of what is said by Michelson and Mallock, there are a number of iridescent scales in Lepidoptera, *Hypolimnas bolina*, etc., which, though perfectly transparent, are absolutely colourless. There is the still more anomalous case of the two surface layers of scales of *Morpho achilles*, and other similar species. I should be greatly interested if any of your readers could offer a probable explanation. The appearance of these scales is as follows:—They are perfectly transparent, closely striated, very thin (probably not much more than $0{\cdot}5\mu$), and by reflected light they are a bright light blue, which is practically unaltered by the angle of the incident light. *In situ* they show faint diffraction colours due to their striation. But the point to which I wish to direct attention is that, when examined by transmitted light under the microscope, they still have a *blue* colour, which is, if anything, more saturated than that shown by reflected light. This colour, though not unlike the "optical blue" of the sea and other fine suspensions, cannot be due to a similar cause, since the light transmitted is not red. It is clearly visible with a Zeiss AA objective, but practically invisible with higher powers—DD, etc. Moreover, if the scales are examined with an AA objective, and the condenser racked down, the blue colour will gradually disappear as the condenser is raised until it becomes invisible with critical illumination. These scales have, as a matter of fact, been mentioned by Biedermann, but he entirely fails to notice their significance.

H. ONSLOW.

3 Selwyn Gardens, Cambridge, March 15.

Matter and Radiation.

THE theory that matter only radiates energy to matter, as suggested by Dr. Shapley and Prof. Soddy in their interesting letters (March 13 and 20), would certainly solve the great problem of solar energy, and is in many ways attractive. But is not the evidence against it very strong? Amongst various arguments that may be advanced against it, let us consider that of the difficulty of reconciling it with the existing surface temperature of the earth.

It is evident that there is an approximate balance between the radiation received by the earth from the sun and that lost, the latter being very slightly larger owing to the heat conducted outwards from the centre. The mean temperature of the earth is about what we would expect on the assumption that it is receiving heat at a known and measured rate from the sun and radiating it uniformly in all directions in accordance with Stefan's law. The fraction of the total solid angle which is subtended by matter is apparently almost infinitesimal, yet the quantity of heat radiated agrees with that deduced from experiments in which the radiating body is entirely surrounded with matter. If we assume that surrounding matter only influences the distribution, and not the total flux of radiation, we are led into all sorts of further difficulties. For example, a large part of the radiation from the dark side of Venus would have to be directed towards the earth, so that the radiation received from Venus should be comparable with that received by Venus from the sun.

Another way of turning the same argument is to consider an isolated solar system. No heat could escape, so it would resemble a system in a perfectly reflecting envelope. Equilibrium would then only be reached when all the members had attained the same temperature. The isolation of the actual solar system in space should certainly be sufficiently close to ensure that its members would attain a temperature approximating to that of the sun.

It is possible that this argument is not new, and that there may be some way of evading it, but, as it appears to be difficult to do so, I think it is worthy of consideration.

HORACE H. POOLE.

Physical Laboratory, Trinity College,
Dublin, March 26.

National Fisheries.

IN NATURE of March 13 is published a paragraph on British fisheries in which the following passage occurs:—"To the trade, fish that is scarce and dear is easier to handle than, and at least as profitable as, fish that is cheap and plentiful. From the point of view of the consumer and of the State, cheap food, a large and prosperous fishing population, and, if possible, some revenue, ought to be the objects of reconstruction of the industries concerned."

The note suggests an antithesis which has no foundation in fact. The fishing industry—producers, research workers, and the "trade"—bases the claim for reconstruction, which this association has voiced, on the fact that it desires to supply the nation with cheap fish. But cheap fish can be supplied only when plentiful catches *and regular* catches are assured, and to ensure regularity—that is the real crux—without

©1919 Nature Publishing Group

simplifying the existing fishery law and administration is hopeless. No one interested in the development of British fisheries believes in the economic fallacy contained in the first sentence I have quoted from your pages. To quote Mr. Secretary Cecil in 1563:—"The causes of the decay of fishing must be the lack of the use of fishing, which must be divided into ij partes, small eating of fisshe in ye Realme, and not selling of it abroad." Both these causes have operated during the war. It is our purpose to remove them both. As this is not always understood, I shall be glad if you will publish this declaration, which can be taken as "official" on behalf of every branch of the fishing marine, to which the nation owes its freedom in 1919, as it did in 1588.

G. C. L. Howell.

National Sea Fisheries Protection Association,
Fishmongers' Hall, E.C.4, March 24.

I entirely agree with Capt. Howell, and think that the road to fishery reconstruction, in the national interest, is marked out by the lines of the propaganda of the National Sea Fisheries Protection Association. I am sorry if it should appear that anything in the views put forward in the *Times* correspondence and articles is misrepresented in the note in Nature of March 13, but it seemed to me that Lord Dunraven's letter did suggest such an antithesis as that to which Capt. Howell refers—that fish which is scarce and dear might be more profitable and more easy to handle than fish which is cheap and abundant, and that while the former condition might possibly be preferred by the distributing trades, the latter condition is that which is favourable alike to the nation as a whole and to the consumers in particular. In order to make it impossible that the former condition might be established, Lord Dunraven seems to suggest some form of nationalisation of the fisheries; this would also, he hopes, create revenue. The National Sea Fisheries Protection Association, on the other hand, seeks to secure the same object by its advocacy of a strong Imperial administration—a sounder method, it seems to me, for better than State revenue would be a prolific fishery population retaining its individuality; and largely increased British exports would be preferable to Lord Dunraven's Colonial imports. The note was intended to be purely descriptive, and so my personal opinions were not expressed.

The Writer of the Note.

Coal in Thrace.

I am much obliged to Prof. Louis for his interesting information (Nature, March 20, p. 45).

I assumed the coal to be anthracite on account of the assertion that the use of the bellows extinguished it, while it encourages the combustion of bituminous coal by a fuller supply of oxygen. The high temperature needed for the burning of anthracite would not be attained, I fancied, owing to the cold blast.

The geographical description does not apply to Pontos.

There is another "wonder" cited by Antigonos that has a possible bearing on the coal district of Thrace. He quotes Eudoxos as saying: "It is related that in the Thracian Sea, at the mountain which is called Sacred, during certain times bitumen (*asphaltos* in the Greek) is borne on the surface."

The *Mare Thracicum* in Kiepert's atlas extends from Thrace north of the Hellespont to the coast of Thessaly. The "Sacred Mountain" is probably Mount Athos, which in vulgar speech is still called "Hagion Oros."

Edmund M'Clure.

80 Eccleston Square, March 24.

THE MACHINERY OF GOVERNMENT.[1]

"A MAN without a purpose," said Carlyle, "is like a ship without a rudder." What is true of an individual is in this case true of a community: a people without a common purpose can make no permanent progress. It must stagnate and ultimately disintegrate. In the last resort a free people can only be held together by either of two means: custom or community of purpose. It is not difficult to see that anything—and not least the machinery of Government—which facilitates the coherence of free people, whether in a single State or in a world commonwealth, and their co-operation towards the fulfilment of a common purpose, makes for the welfare and advancement of mankind.

During the war many English customs have been broken down, but the consequent tendency towards disintegration has been more than counterbalanced by the increased sway of a common purpose. Higher efficiency and more rapid progress have consequently become apparent in multifarious departments of the national life, as, for example, the exhibition of British scientific products held in London last summer, and repeated this winter in Manchester, has shown in the case of scientific industry. But with the signing of the armistice community of purpose began to lose its hold, and disintegration threatens to set in. Labour leaders are warning the nation against it, and leading articles in the *Times* are echoing and emphasising their warnings.

How is this danger to be avoided? New habits and customs take time to form. Moreover, as we may perhaps learn from the Americans, bondage to custom causes many of the evils that result from other kinds of fetters. So the prosperity, progress, and even preservation of the State demand, above all, community of purpose. Perhaps spiritual ideals alone can supply it, and the essential emotional drive towards its realisation. But, whatever the purpose be, some central Government is needed to plan and to direct the advance towards it. This—and not merely to police the route—is the function of the Government of a State.

In the past, of course, this function is very far from having been fulfilled, whether by Ministers of the Crown, who determine policy, or by the permanent Civil Service Departments, which pursue it. When Mr. Gladstone entered Parliament in 1832 he thought his first concern would be with questions of the succession to certain unstable European thrones. A dozen years later, after a close connection at the Board of Trade with the leaders of British industry and commerce, he held a very different view. But it has taken a long time for these industrial statesmen, these leaders of British activity outside the House of Commons, to see in the Government and its principal Departments the natural centre and focus of their activities in the service of the State. The process is not yet complete; nor have some captains of

---

[1] Report of the Machinery of Government Committee. Ministry of Reconstruction. (Cd. 9230.) (H.M. Stationery Office.) Price 6*d*. net.

©1919 Nature Publishing Group